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ABSTRACT

This study examined whether U.S., Australian, and Swedish grade 9 male and female students' beliefs about themselves as learners of mathematics and English/Swedish differed. The cohort of grade 9 students from one coeducational school in each country participated in the study. Questionnaires were distributed in the three countries and contained Likert-type items, rating scales about students' beliefs, and open-ended questions. Summary of data suggest: (1) gender differences were more apparent for language arts than for mathematics; (2) females tended to enjoy both mathematics and language arts more than males; (3) males were more likely than females to hold an opinion on whether women or men were better at either mathematics or language arts; and (4) surprisingly strong perceptions existed across the three countries that language arts was a female domain. The research presents the challenge to educators to address the perception of language arts as a female domain and recommends further investigation of the finding. Contains 17 references. (EH)

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MATHEMATICS and LANGUAGE STUDIES: A Cross-National Comparison

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Mathematics and language studies: A cross-national comparison

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Introduction

Stereotyped perspectives of the academic disciplines portray mathematics/science [MS] as male and Language Arts [LA] as female domains. Characteristics of the fields parallel Broverman's (1972) findings on the stereotyped images of men and women. MS (and males), for example, are considered 'logical' and objective while LA (and females) are perceived as 'sensitive' and subjective. Recent research findings confirm that these images linger. Male and female university students in Britain rated mathematics to be masculine and English to be feminine (Archer & Freedman, 1989). The gender differences noted by Skaalvik and Rankin (1994) for Norwegian grade 6 and 9 students' self-concept and self-perceived skills levels in mathematics and LA confirmed expectations based on gender stereotypes.

Attribution and achievement

Attribution-achievement studies (Bar-Tal, 1978) have revealed that those with high achievement needs were more likely to attribute their success to ability (an internal factor) as well as to effort; their failures to lack of effort or external factors. In contrast, those with low achievement needs tended to ascribe their successes primarily to external factors and their failures to lack of ability. Working with algebra students, Kloosterman (1990) reported significant positive attributions between achievement and attributions. In an influential study Weiner (1974) found that attributing success to a stable internal factor (such as ability) was positively related to task persistence and feelings of confidence.

Gender differences in attributional patterns

Gender differences in patterns of causal attributions for success and failure are often, though not invariably, found for 'masculine' domains such as mathematics (Wolleat et al., 1980). Bar-Tal and Frieze (1977) reported that when college students were given an English anagram task, the successful students perceived themselves as having higher ability and trying harder than did the failing students. Only one significant gender difference was found: females tended to attribute their success to environmental factors and luck more than did males. Often females, particularly in situations involving success, rated their ability lower than males (Bar-Tal, 1978). Bar-Tal and Frieze (1977) reported that the attributions of low achievement-motivated groups of males and females were similar, although the females were more likely to use task difficulty to explain their failures and to rate their abilities slightly higher. Pedro et al. (1981) noted that females in ninth and tenth grade were less likely than males to attribute their success in mathematics to ability, but showed higher levels of anxiety (and lack of confidence). According to a recent study by Li and Adamson (1995), secondary gifted female students were more likely than males to attribute their successes and failures in mathematics, science, and English to effort and strategy, and appeared more confident about English than males.

Ryckman & Peckham (1987) compared attribution patterns for MS and LA among grade 9-12 students. No gender differences were found for effort attributions. Compared with their ability

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attributions for LA, females saw little MS success attributable to ability. Males' success ability attributions were no different for the two subjects and there were only small differences (MS higher) for failure.

To summarise: when differences are found, males, as a group, are more likely than females, as a group, to attribute mathematical success to ability and failure to lack of effort. Females are more likely than males to attribute success to effort and failure to lack of ability (Leder, 1992). When failure is perceived to be due to lack of ability, increased effort appears unable to reverse that failure. Attribution of success to ability, on the other hand, is more likely to yield a belief in a high likelihood of future success. Thus the attributional patterns more frequently associated with females may be an important factor inhibiting their achievement.

The case against generalisations

The complexity and difficulty of describing the relationship between attitudes (with attributions considered an important component) and achievement have been highlighted by Stanic and Hart (1995). Their interviews with seventh grade capable female students revealed inconsistencies between the students' confidence and achievement levels in mathematics. Some high achieving females indicated a low level confidence about their mathematics proficiency. No significant gender differences in performance in mathematics or LA were found by Marsh (1989), despite significant differences in the reported attitudes to these subjects for his sample of Australian high school students. For Stockard and Wood's (1984) sample of secondary students, gender differences in performance (as measured by grades) were stronger for English than mathematics. More generally, meta-analysis of studies concerned with mathematics achievement reveal that gender differences are typically small and appear to be decreasing (Friedman, in press), a finding confirmed by a longitudinal study of student achievement in the popular Australian Mathematics Competition (Taylor et al., 1996).

Some research on attributions for success and failure has concentrated on gender differences. Cross-national comparisons of males' and females' beliefs about mathematics and LA, and success in those areas, have not been examined extensively. In this study data from the USA are compared with those from two other countries, Australia and Sweden, in which American influences (eg. TV, movies, publications) are strong. There is thus considerable overlap, as well as some undeniable differences, in the broad social context in which learning takes place in these countries.

THE STUDY

Aims

We examined whether American, Australian and Swedish grade 9 male and female students' beliefs about themselves as learners of mathematics and English/Swedish differed. More specifically, would males and females in these countries:

* attribute their successes and failures in the two subject areas differently?
* hold different beliefs about their achievement levels in the two subjects?
* view mathematics and English/Swedish as stereotyped domains?

Sample

The cohort of grade 9 students from one coeducational school in each country participated in the study. The Australian school was a grade 7-12 government high school located in the outer suburbs of metropolitan Melbourne. Situated in a small city in the south of the country, the Swedish government school was for students from grades 1-9. The USA school was a public

high school (grades 9-12) situated in Denver, Colorado. The sample sizes were: Australia, 187 (97M, 90F), Sweden, 76 (34M, 41F, 1?), and USA, 92 (37M, 54F, 1?).

Methods and data sources

A questionnaire was administered to the students in the three countries[1]. Items that had been prepared to determine beliefs about mathematics were slightly adapted for LA (English /Swedish). There were three parts to the questionnaire:

1. The Mathematics Attribution Scales [MAtS] (Wolleat et al., 1980) consisting of four success-related and four failure-related items. Responses to each of four statements (referring to ability, effort, task and environment) following each item are given on 5-point Likert-type scales (strongly agree to strongly disagree). Subscale scores are obtained by summation. The range of scores for each subscale is 4-20. The MAtS were suitably modified for LA.

2. For mathematics and LA, six items probed students' beliefs about: personal and aspired achievement levels; teachers', parents' and classmates' ratings of achievement; and parents' desired achievement levels. Responses were on 5-point scales: 1 = weak to 5 = excellent.

3. Three open-ended items: Do you like mathematics/LA?; What makes a person good at mathematics/LA?; Are women better than men at mathematics/LA?

The scorable data were analysed using $SPSS_{PC}$. Open-ended responses were analysed manually.

Results

A. Scorable data

To investigate similarities and differences by gender and by country for students' mathematics and LA success and failure attributions and for their beliefs about achievement levels, two-way ANOVAs (gender x country) were conducted on each subscale of the attribution scales and on the six achievement belief items. Mean scores by gender and by country, as well as significant p-levels are shown in Table 1.

Data from students in each country were also investigated separately. Paired t-tests enabled subject-related differences to be examined separately for males and for females. To examine for gender differences within each subject area, independent-groups t-tests were carried out.

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[1] We thank Barbrō Grevholm (Lund University) for translating the questionnaire into Swedish and the students' responses into English and Kerstin Persson (Lund University) for organising the administration of the questionnaires.

Table 1 **Results of two-way ANOVAs (gender x country)**

	MEAN SCORES (male, female) and p-levels MEAN SCORES (Australia, Sweden, USA) and p-levels	
Variable	**MATHEMATICS**	**LANGUAGE**
Self-rating of achievement	3.31, 3.23 3.26, 3.07, 3.42	3.44, 3.67 (<.001) 3.61, 3.68, 3.38 (<.05)
Desired achievement rating	4.72, 4.71 4.79, 4.58, 4.65 (<.05)	4.73, 4.78 4.82, 4.72, 4.66 (<.05)
Believed teacher rating	3.22, 3.19 3.20, 3.10, 3.30	3.21, 3.46 (<.05) 3.28, 3.49, 3.35
Believed parents' rating	3.62, 3.61 3.46, 3.73, 3.86 (<.01)	3.60, 3.81 (<.05) 3.71, 3.74, 3.70
Believed parents' aspiration level	4.70, 4.62 4.80, 4.09, 4.79 (<.001)	4.67, 4.65 4.78, 4.21, 4.75 (<.001)
Believed classmates' rating	3.33, 3.46 3.44, 3.25, 3.44	3.43, 3.81 (<.001) 3.70, 3.70, 3.44 (<.05)
Success/Ability	13.17, 12.45 12.56, 12.67, 13.32	13.42, 14.07 (<.05) 13.88, 14.05, 13.39
Success/Effort	12.22, 12.72 13.16, 10.22, 12.85 (<.001)	12.47, 13.20 (<.05) 13.39, 10.95, 13.20 (<.001)
Success/Task	13.72, 13.13 (<.05) 12.85, 14.18, 13.94 (<.001)	13.80, 14.26 14.26, 14.25, 13.51
Success/Environment	13.06, 13.42 13.73, 11.24, 13.81 (<.001)	11.69, 13.16 (<.001) 12.10, 11.41, 14.19 (<.001)
Failure/Ability	12.34, 12.91 12.83, 12.49, 12.40	12.23, 11.16 (<.001) 11.64, 10.79, 12.20 (<.05)
Failure/Effort	12.75, 12.51 12.28, 13.01, 13.03	12.56, 12.24 12.26, 12.47, 12.56
Failure/Task	13.54, 14.24 (<.05) 14.52, 13.73, 12.81 (<.001)	12.82, 12.70 13.15, 11.92, 12.49 (<.05)
Failure/Environment	11.84, 11.72 11.91, 11.66, 11.59	12.36, 11.85 12.64, 11.34, 11.45 (<.001)

Table 1 indicates that there were more statistically significant gender differences for LA (8) than for mathematics (2). A similar number of significant differences by country were found for the two subject areas; 9 for LA and 7 for mathematics. Caution is required in the interpretation of the frequency of significant differences by country. While cultural factors may be a partial explanation, other factors might also be involved, e.g. differences in curriculum and classroom practices. Since the participants in this study were drawn from only one school in each country, school factors may also be implicated.

A summary of the findings with respect to the aims of the study is presented below:

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1. **Success and failure attributions**

a. by gender

Gender differences were more apparent for LA than for mathematics.

* ***For LA:*** Females attributed success to ability, effort and environment more strongly than males. Females also attributed failure to ability less strongly than males. Thus females seem to have more functional attributions of success and failure in LA than do males.

  In Sweden, males and females differed in ability attributions with the females' means higher for success and lower for failure than the males'. For the USA students, the males scored both success and failure to effort higher than the females. Gender differences were most prevalent for the Australian sample. Compared with the males, the females attributed success to environment more strongly and failure to ability, effort and environment less strongly.

* ***For mathematics:*** The only significant differences were for attributions to task. Males attributed success to task ease more strongly than females. Males also attributed failure to task difficulty less strongly than females.

  In Sweden and the USA, there were no significant gender differences. For the Australian sample, males attributed success to ability more strongly and failure to lack of ability and to task less strongly than did females.

b. by country

* ***For LA:*** Swedish students had lower attributions for success to effort and environment than the other two groups, and for failure to ability, task and environment

* ***For mathematics:*** Swedish students had lower attributions for success to effort and environment, but higher to task, than the other two groups. For failure, the only significant difference was for task, with the Australian students having the highest mean score and the USA students the lowest.

There were no subject-related differences for USA females. Females in Australia and females in Sweden had more functional attribution patterns for LA than for mathematics with attributions for success to task higher and for failure to ability and task lower for LA than for mathematics. Australian males' attributions of success to task and failure to environment were higher, and for success to environment and failure to task lower for LA than for mathematics. Swedish males attributed success to effort more strongly for LA than for mathematics. USA males attributed success to task more strongly for mathematics than for LA.

Summary: There was greater variation in attributions for success and failure by gender for LA than for mathematics. Females tended to hold more functional attributions for LA than did males. Only for the Australian sample did gender differences in attributions for success and failure in mathematics replicate some previously reported findings. Subject-related differences were most evident among Australian students and least among the USA students.

2. Beliefs about achievement levels

There were some interesting similarities in the data from the three countries. The following

relationships held both for LA and for mathematics.

For each country:

* the students would like to be better at the subject than they are
* mean perceived teacher ratings for the subject were very similar
* the students believed that their parents would like them to be better at the subject than they are
* the students believed that their classmates would rate their achievments about the same as they rate themselves

Significant gender differences and differences between the countries were noted:

a. by gender

* ***For LA:*** Females rated their achievements higher than did males. Females' perceived ratings of achievement by teachers, parents and classmates were significantly higher than males'.

  For the Australian sample, the pattern of significant gender differences was the same as for the combined sample described above. For Swedish and USA students there were no significant gender differences noted, although directional trends were very similar for each of the varables.

* ***For mathematics:*** No significant gender differences were found. This was also the case for students within each country.

b. by country

* ***For LA:*** USA students rated their achievement lower than the other two groups and also rated their classmates' expectations lower. Swedish students appeared to believe that their parents have lower expectations of their performance than do the other two groups.

* ***For mathematics:*** While students in all three countries would like to do very well, the Australian students' mean score was highest. Australian students believed their parents would rate their performance lower than did students from the other two groups. Swedish students indicated that their parents have lower expections of their performance than students from the other countries.

  There were no subject-related differences for males or females in the USA sample, or for Australian males. Australian females thought they were better at LA than mathematics, and that their teachers, parents and classmates would rate their LA achievements higher than mathematics. Swedish males and females believed they were better at LA than mathematics and that their classmates would rate their LA achievements higher. Swedish males also believed that their teachers would rate them higher in LA than mathematics.

Summary: There were several similarities in the patterns of students' beliefs about achievement in mathematics and LA in the three countries. Females, however appeared more confident than males about their achievements in LA, and about others' perceptions of their achievements. It was noteworthy that there were no gender differences in beliefs about mathematics achievements. Compared to the students in the other two countries, however, Swedish students' indicated that their parents had lower expectations of their achievements in

both subjects. While there were no subject-related differences among US students or among Australian males, Swedish students and Australian females appeared more confident about their achievements in LA than in mathematics.

B. Open-ended items

Responses to the questions "Do you like mathematics/LA?" and "Are women or men better at mathematics/LA?" were sorted into categories. Percentage frequencies were calculated separately for mathematics and for LA, and for males and females in each of the three countries. The results are shown on Tables 2 and 3 respectively.

Table 2: Do you like mathematics/LA? Percentage frequencies of responses by country and gender.

	YES		NO		SOMETIMES		Don't know	
	Male	Fem	Male	Fem	Male	Fem	Male	Fem
Australia M	46	37	28	30	26	33	-	-
LA	42	51	29	9	29	39		
Sweden M	21	31	59	50	18	17	3	2
LA	29	52	53	19	15	26	3	3
USA M	44	57	41	30	8	4	8	9
LA	41	51	33	28	26	19	-	2

The results on Table 2 indicate that:

For mathematics:

- in Australia and the USA (but not Sweden) more students (both males and females) liked than disliked mathematics
- in Sweden and the USA (but not Australia) more females than males liked mathematics. There was a mixed pattern for disliking mathematics

The reasons given by students from each country for liking/disliking mathematics were very similar. The most common reasons for enjoying mathematics included: easy, fun, understand it. Reasons for disliking mathematics students included: difficult, not good at it, boring, and the teacher. A few typical responses are shown below:

> No, I've never liked math. It's really boring (USA, male)
>
> Yes, I think it is easy, fun and interesting (Sweden, female)
>
> No, I don't like maths any more. I used to but now the teacher we have is no good. He has no patience with people who are wrong (Australia, female)

For LA:

- in all three countries, more females (≈50% in each country) than males liked language
- in all three countries, more males than females disliked language
- compared to the USA and Australia, Swedish males were less likely to like language

The reasons put forward for liking LA were similar in the three countries. LA was liked because: it is interesting, enjoy reading, writing etc., good teacher, and fun. Variation was more evident in the reasons given for disliking LA. Only in Sweden, for example was dislike of grammar sometimes mentioned and Australian students were more likely to cite the teacher as the cause of their dislike of the subject. A few examples are presented below:

> I used to like English but this year my teacher has made a lot of people hate English because she doesn't listen to people and puts everyone down all of the time. (Australia, female)
>
> No, boring with such things as grammar and such things (Sweden, male)
>
> Yes, I do find English interesting because I like to write (USA, female)
>
> Yes, I like to write stories and poems and it is fun getting a good mark in the subject (Sweden, female)

Mathematics compared to LA:

- within each country, the percentage of males who liked mathematics was about the same as the percentage liking language (similarly for disliking mathematics and language)
- in Sweden and Australia (but not the USA), more females liked language than liked mathematics (similarly for disliking mathematics and language)

Summary: Females tended to enjoy both mathematics and LA more than males. Females also showed greater variation in their enjoyment of the two subjects than did the males. Females appeared to enjoy LA more than mathematics while for males the two subjects tended to be liked equally. The patterns were very similar in the three countries. However, compared to the males in the USA and Australia, Swedish males appeared to enjoy both subjects less.

Table 3: Do you think men or women are better at mathematics/LA? Percentage frequencies of responses by country and gender:

	Women better		Men better		Equal		Don't know/no answer	
	Male	Fem	Male	Fem	Male	Fem	Male	Fem
Australia M	13	9	23	2	45	77	13	2
LA	21	16	6	-	47	74	9	7
Sweden M	47	31	21	12	12	43	21	14
LA	47	40	18	-	12	45	23	15
USA M	21	13	15	13	49	68	15	6
LA	18	19	8	4	59	68	15	9

The results on Table 3 indicate that:

For mathematics

- in each country, more females than males said there was no difference between men and women (Swedish students were less likely than Australian and USA students to say this)
- in each country more males than females said that *women* were better. Biggest gender

difference was for Swedish students [M: 47%, F: 31%].

* in each country more males than females said that *men* were better. Gender difference for Australians was greatest [M: 23%, F: 2%]

From all three countries, some variation was evident in the reasons put forward for men or women being considered better at mathematics. Students favouring women were more likely to include comments about effort. Reasons for men and women considered equal in ability were similar in all three countries. Typical examples are shown below:

Women because they study and take it more seriously (Australia, female)

Women, they are not as lazy as men (Sweden, male)

Men. I think men are best at math because men are smarter (USA, female)

Equal. Women and men are equal in all things (USA, male)

For LA:

* in each country, more females than males said there was no difference between men and women (Swedish students least likely to say this). Biggest gender difference among Australians [M: 47%, F: 74%]
* in each country, the proportions of males and of females who thought *women* were better were fairly similar
* in all three countries more males than females believed *men* were better (no females in Australia or Sweden said men were better). Biggest gender difference in Sweden [18%, 0%]
* in each country, women were considered better than men by more male students and also by more female students (no consistent pattern for mathematics)

In the three countries, a wide range of reasons were put forward to explain women's superiority in LA. The students, mainly male, who claimed men were better most frequently mentioned general male superiority. The reasons for considering that there was no difference between men's and women's LA abilities were similar across the three countries. Typical examples are shown below:

Men are better because they are better at everything (Australia, male)

Men, they are smartest (Sweden, male)

Women, we take more time and think more about writing (USA, female)

I think both are just as good as each other (Australia, female)

Summary: Males were more likely than females to hold an opinion on whether women or men were better at either mathematics or LA. That is, they were more likely than females to hold stereotyped views (whether or not these conformed to traditionally-held gender stereotypes). LA appeared to be traditionally gender-stereotyped as a *female domain* (ie. that women were better at LA than men) among both males and females. The results appear to challenge the traditional stereotyping of mathematics as a *male domain* (females rejecting this notion fairly universally). A surprisingly large proportion of both males and females (Swedish students in particular) were found to consider women to be better at mathematics than men. Interestingly,

more females in each of the three countries thought that the sexes were equal in both mathematics and LA.

Conclusions and educational importance

The findings reported here reveal some subtle gender differences in the ways in which Australian, Swedish, and American students describe their success and failure in mathematics and LA. There is considerable overlap with previously reported findings in the literature. For mathematics the only significant differences found for our sample were for task, with males having a higher attribution for success, but lower than failure for task/failure. Some interesting variations were also noted when data from the three countries were compared. Gender-stereotyping appeared to be less rigid than in the past. Yet, in Sweden, a nation generally viewed as 'progressive', stereotyping of women being better at LA was still evident.

Stereotyping was more evident for LA than for mathematics in all three countries. The emphasis in recent years on gender issues in mathematics and science, but not in LA, may partially account for this finding. Anecdotal evidence further suggests that, while it has become more acceptable for women to pursue any career, it is less acceptable for males to take on traditional female pursuits, e.g., poetry, language arts, nursing.

Some interesting similarities across the three countries emerged from the data. Students would like to be better than they are at mathematics and LA. Their perceived teacher ratings for both LA and for mathematics were remarkably similar. While they believed that their parents would like them to be better than they were in both subjects, they considered that for each subject their peers would rate them about the same as they rated themselves.

It will be interesting to determine whether the decreased stereotyping in mathematics, evident in this study, are replicable with other samples and other instruments. The surprisingly strong perceptions across the three countries of LA as a female domain present a challenge to language educators in particular and warrant further investigation.

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